



**National Aeronautics and
Space Administration**

May 16, 1997

NRA-97-MTPE-07

RESEARCH ANNOUNCEMENT

**ATMOSPHERIC CHEMISTRY MODELING AND ANALYSIS PROGRAM
and
TOTAL OZONE MAPPING SPECTROMETER SCIENCE TEAM**

Letters of Intent Due June 27, 1997 (4:30 PM EDT)

Proposals Due August 15, 1997 (4:30 PM EDT)

OMB Approval No. 2700-0087

**ATMOSPHERIC CHEMISTRY MODELING AND ANALYSIS PROGRAM
and
TOTAL OZONE MAPPING SPECTROMETER SCIENCE TEAM**

**NASA Research Announcement
Soliciting Research Proposals
for
Period Ending
August 15, 1997**

**NRA 97-MTPE-07
Issued May 16, 1997**

**Office of Mission to Planet Earth
National Aeronautics and Space Administration
Washington, DC 20546**

RESEARCH ANNOUNCEMENT FOR THE ATMOSPHERIC CHEMISTRY MODELING AND ANALYSIS PROGRAM AND TOTAL OZONE MAPPING SPECTROMETER SCIENCE TEAM

This NASA Research Announcement (NRA) solicits research proposals for science investigations to be carried out under the Atmospheric Chemistry Modeling and Analysis Program (ACMAP) of the Science Division of NASA's Office of Mission to Planet Earth (MTPE) and for a newly reconstituted science team set up for the Total Ozone Mapping Spectrometer (TOMS) series of satellite instruments. ACMAP supports research in computational modeling and data analysis for studies on the trace constituent distributions of the troposphere and stratosphere, as well as dynamical properties of the stratosphere. A fuller description of ACMAP is found in Appendix A of this NRA. TOMS is an instrument designed to measure the total column abundance of ozone in the atmosphere with high horizontal resolution; two TOMS instruments are currently operating, and a third TOMS instrument is scheduled for launch in the year 2000. A fuller description of the TOMS instrument and science is found in Appendix A of this proposal.

ACMAP supports approximately 70 investigators, and had a budget of \$6 million in FY96. In order to support enhanced modeling of tropospheric chemistry and improved analysis of in situ trace constituent measurements in the troposphere, plans exist to augment the ACMAP budget by approximately \$0.5 million per year beginning FY97. Budget uncertainties may reduce the amount of or eliminate this increase in FY98, however.

This solicitation is to encourage the submission of proposals (a) for new tasks within ACMAP, emphasizing the desired increase in focus on tropospheric chemistry and (b) for membership on the TOMS Science Team, which will be reconstituted following the selection of proposals submitted in response to this NRA. Appendix A also describes in additional detail the science questions for which ACMAP proposals are most desired. Proposals for other areas within ACMAP may be submitted in response to this NRA, although little growth in funding is anticipated for them. Existing grants, contracts, and interagency agreements already funded within ACMAP that expire at the end of FY97 or during FY98 must also be submitted in response to this NRA to ensure the possibility of continuation beyond the currently planned expiration of funding. Areas of greatest interest for the TOMS Science Team are outlined in Appendix A.

This NRA solicits two classes of proposals. The first is the standard three-year ACMAP research proposal, which may relate to any of the areas of ACMAP science as described in Appendix A (not just the areas of greatest interest for new or redirected existing tasks). It is expected that somewhere between 10 and 20 tasks of size varying from approximately \$35,000 to \$275,000 per year will be selected in response to this NRA (note these totals include both new proposals and renewals of currently-funded proposals). Most ACMAP tasks are in the \$75,000 to \$150,000 per year range, with larger tasks typically being restricted to computationally-intensive modeling tasks which actively support internationally-organized assessment activities. ACMAP funding is available only to modeling and data analysis tasks. **Funding for laboratory or field measurements will not be provided under ACMAP**, and any experimental or field measurement proposals submitted as ACMAP proposals will be returned as non-responsive.

The second class of proposals is for the TOMS Science Team being reconstituted with this announcement. The budget available for TOMS Science Team proposals being selected in response to this announcement is approximately \$1 million per year, with the possibility that funding amounts in early years may be somewhat smaller than that amount. As detailed in Appendix A, investigations to be supported under the TOMS Science Team include not only data analysis and interpretation, but also correlative measurements/validation, algorithm studies, and applications.

Because of the similarity in scientific objectives relative to analysis and interpretation of TOMS data, TOMS Science Team membership may be conferred on some investigators whose proposals are selected as part of the ACMAP part of the solicitation. Investigators may request that proposals be considered in both the ACMAP and TOMS categories; it is quite likely that some tasks may receive joint funding from the ACMAP and TOMS programs.

Proposals may be submitted at any time during the period ending August 15, 1997, but not later than 4:30 p.m., e.d.t. on August 15, 1997. Proposals received after that date will be handled in accordance with NASA policy concerning late proposals (NFS 1815.412). Proposals will be peer reviewed by approximately October 31, 1997. If accepted, they will be integrated into the FY98 research program beginning approximately January 1, 1998.

Participation in ACMAP and TOMS is open to all categories of organizations: educational institutions, industry, non-profit institutions, NASA centers, other US Government agencies, and international educational institutions, industries, and government agencies.

Funds are not presently available for awards under this NRA. The Government's obligation to make awards is contingent upon the availability of appropriated funds from which payment for award purposes can be made and the receipt of proposals which the Government determines are acceptable for award under this NRA.

Appendix A provides technical and programmatic information concerning the scope, foci, and objectives of the scientific activities covered by this

Announcement, as well as specific instructions for proposers to this NRA. Appendix B contains the basic guidance needed for preparation of proposals in response to an NRA. Appendix C provides guidance for foreign participation. Appendix D includes required certifications and proposal cover sheet, which must be completed and returned to NASA with any proposal submitted in response to this NRA.

All prospective proposers to this announcement are strongly encouraged to submit a letter of intent no later than 4:30 PM on Friday, June 27, 1997. This will allow us to organize our peer review staff to adequately support the proposal review process. This letter of intent is available electronically via the Internet at URL <http://www.mtpe.hq.nasa.gov/LOI/form.html>. The URL for co-investigator information is <http://www.mtpe.hq.nasa.gov/LOI/coi.html>. It is requested that these electronic letter of intent forms be used by all prospective proposers, although those lacking access to the Internet may submit a letter by fax to (202) 554-3024 with the following information:

- PI and CoI names and addresses (including Zip + 4)
- Title of proposal
- Contact information (phone and fax numbers and electronic mail address) for PI
- A brief summary of the proposed research (Please limit this to no more than 3000 characters)

Identifier: NRA-97-MTPE-07

Submit Letters of Intent and Proposals to:

ACMAP/TOMS NRA
Code Y
400 Virginia Avenue SW, Suite 700
Washington, DC 20024

For overnight mail delivery purposes only the recipient telephone number is (202) 554-2775.

Copies Required: 10

Selecting Official: Director, Science Division

Obtain Additional Information From: Dr. Jack A. Kaye
ACMAP Manager/TOMS Program Scientist
NASA Headquarters, Code YS
Washington, DC 20546
Tel.: (202) 358-0757
Fax: (202) 358-2770
e-mail: Jack.Kaye@hq.nasa.gov

Additional information on the TOMS instrument, archived data sets, and data availability may be obtained from the TOMS Project Scientist:

Dr. P. K. Bhartia

TOMS Project Scientist
NASA Goddard Space Flight Center, Code 916
Greenbelt, MD 20771
Tel: (301) 286-4094
Fax: (301) 286-1662
e-mail: bhartia@chapman.gsfc.nasa.gov

Your interest and cooperation in participating in this opportunity are appreciated.

W. F. Townsend
Acting Associate Administrator
Office of Mission to Planet Earth

Enclosures:

Appendix A, "Technical Description and Specific Guidelines for Proposers to this Announcement"

Appendix B, "Instructions for Responding to NASA Research Announcements"

Appendix C, "Guidelines for Foreign Proposals"

Appendix D, "Required Certifications and Cover Sheet"

APPENDIX A:

TECHNICAL DESCRIPTION AND SPECIFIC GUIDELINES FOR PROPOSERS TO THIS ANNOUNCEMENT

Atmospheric Chemistry Modeling and Analysis Program (ACMAP)

The primary objective of ACPMAP is to study the distribution of trace constituents in the global troposphere and stratosphere through the use of computational models and the analysis of spatially and temporally extended data sets. ACPMAP also supports the bulk of NASA's studies of stratospheric meteorology, and of the dynamical, chemical, and radiative couplings between the Earth's stratosphere and troposphere as well as the stratosphere and upper atmosphere (mesosphere/thermosphere). Efforts within ACPMAP emphasize the global atmosphere, although some consideration is given to the large regional (continental and hemispheric) scales; ACPMAP does not support studies at local scales. ACPMAP only supports proposals in the areas of data analysis, interpretation, and modeling. **ACPMAP does not support proposals for laboratory work or field measurements.**

Current research in ACPMAP may be thought of as being broken down into several categories. A listing of these categories, together with brief descriptions and their approximate fraction of ACPMAP in FY97 follow:

- **Stratospheric Dynamics and Related Data Analysis (20%):** Modeling and data analysis studies of temperature and wind distributions of the stratosphere, transport processes in the stratosphere, and their long-term evolution, as well as dynamical couplings between the stratosphere and regions below (troposphere) and above (mesosphere).
- **Atmospheric Chemistry Data Analysis (30%):** Analysis of satellite and aircraft data on the trace constituent composition of the troposphere and stratosphere, including both short- and long-term variations, as well as re-examination of existing data sets. Data sets of greatest interest are NASA satellite missions and atmospherically-oriented aircraft missions (the stratospherically oriented AAOE, AASE I, AASE II, SPADE, ASHOE/MAESA, STRAT, VOTE/TOTE, and the troposphericly-oriented Global Troposphere Experiment series of campaigns).
- **Aerosols, Stratospheric Clouds, and Radiation (10%):** Studies of the processes by which aerosols and polar stratospheric clouds form in the atmosphere and of the optical and chemical effects they have on radiative transfer in the troposphere-stratosphere system, including ultraviolet radiation at the Earth's surface
- **Two-Dimensional Modeling (10%):** Studies of stratospheric chemistry and transport using two-dimensional models, especially as utilized for internationally organized assessments, such as those of the World Meteorological Organization/United Nations Environment Programme.
- **Three-Dimensional Atmospheric Modeling (25%):** Studies of tropospheric and stratospheric chemistry using three-dimensional models, emphasizing the simulation of the combined effects of chemical and transport properties on atmospheric chemistry;

evaluation of models using ground-, aircraft-, and space-based data forms an important part of these efforts. Some consideration is given to the combined effects of atmospheric chemistry and climate change.

The remaining part of ACPMAP (~5%) goes towards program infrastructure, meetings, student support, and general support of activities which enhance the research effectiveness of principal investigators (PIs) within the program.

ACMAP is only one of several NASA programs supporting modeling and analysis of atmospheric trace constituent measurements. Other NASA programs active in this area include the Interdisciplinary Science Program of the Earth Observing System (EOS), the Upper Atmosphere Research Satellite (UARS) Guest Investigator Program, the Stratosphere Aerosol and Gas Experiment (SAGE II) Science Team, and the Atmospheric Effects of Aviation Project (AEAP) of NASA's Office of Aeronautics. Some modeling activities are also carried out under the Upper Atmosphere Research Program and the Tropospheric Chemistry Program of MTPE. The two- and three-dimensional modeling efforts supported by ACPMAP contribute to a broader NASA effort in atmospheric chemistry modeling, the Global Modeling Initiative, primarily funded by AEAP.

The full range of NASA's research in the area of atmospheric ozone, including plans for future evolution of this research, is described in the Atmospheric Ozone section of the *Mission to Planet Earth Science Research Plan*. This document is available electronically at <http://www.hq.nasa.gov/office/mtpe/draftsciplan/mtpe-srp.htm>. The broader context of NASA's Mission to Planet Earth program may be found in the *Mission to Planet Earth Strategic Enterprise Plan*, which is available at <http://www.hq.nasa.gov/office/mtpe/stratplan/stratplan.html>.

The intention is to maintain support within ACPMAP for each of the above areas, and submission of new or renewal proposals in any of them is invited. The new tasks selected in response to this announcement should help increase the relative proportion of tropospherically-oriented tasks within ACPMAP.

The research areas for which new and/or redirected renewal proposals are most desired are as follows:

- The use of atmospheric models to more accurately infer information about the production, destruction, and transport of trace constituents in the atmosphere, emphasizing interactions between the surface and the troposphere, as well as within the troposphere. Potential areas of interest include surface fluxes of chemically active trace constituents, such as methane, carbon monoxide, and halogenated methanes, surface sinks for trace constituents, and processes which transport constituents in the troposphere over large spatial scales (e.g. convection, interhemispheric mixing). Proposals should relate the modeling approaches to the atmospheric and/or surface data analyzed. Some support for more formal techniques for inverse modeling and/or sensitivity analysis for atmospheric chemistry and transport applications will be considered in this area.
- Tests of use of publicly-available airborne- and/or space-based data to provide information on the trace constituent distribution of the troposphere at regional-to-global scales, emphasizing the lower troposphere, with preference given to studies of trace

constituents in regions of significant anthropogenic sources. Molecules of particular interest include ozone, nitrogen dioxide, sulfur dioxide, and carbon monoxide. Studies proposed in this area should make appropriate use of atmospheric models to ensure that the consistency or inconsistency between observed and expected distributions can be addressed.

TOMS Science Team

The Total Ozone Mapping Spectrometer (TOMS) instrument is a six-channel ultraviolet instrument which was designed to use the backscatter ultraviolet (BUV) technique to determine the total column amount of ozone in the atmosphere. TOMS has been at the forefront of NASA's space-based ozone measurement program with the flight of TOMS instruments aboard NASA's Nimbus 7 satellite (1978 to 1993) and a Russian Meteor-3M satellite (1991-1994). In addition to its information on total ozone, the TOMS instruments have been shown to provide information on atmospheric sulfur dioxide abundances following large volcanic eruptions, the distribution of ultraviolet absorbing aerosols and volcanic ash in the troposphere, the flux of ultraviolet radiation incident at the Earth's surface, and, either together with data from other satellites or based on some assumptions about the distribution of stratospheric ozone, on the distribution of ozone in the troposphere. Two TOMS instruments were launched into orbit during the second half of 1996 and are now returning data on these parameters.

The first of the new TOMS instruments is on NASA's Earth Probe (EP) satellite, which was launched on July 2, 1996, while the second new TOMS instrument flies as part of the Japanese Advanced Environmental Orbiting Satellite (ADEOS), which was launched on August 17, 1996. The two spacecraft are in complementary orbits. ADEOS flies in a polar, sun-synchronous orbit at 800 km, allowing the TOMS instrument, which uses cross-track scanning to make observations between orbital tracks, to make full daily maps over the entire sunlit Earth. EP TOMS was placed into a 500 km sun-synchronous orbit in order to provide improved horizontal resolution for its measurements for viewing aerosol sources (26 km x 26 km at nadir instead of the 42 km x 42 km resolution of ADEOS). As a result Earth Probe TOMS does not provide full inter-orbit coverage at latitudes lower than 60 degrees.

The new TOMS instruments are significantly modified from the previous TOMS instruments, with increased in-flight calibration capability, changes in several of the wavelengths used in the actual measurement, and modified electronics to provide interfaces with the different spacecraft [Krueger et al., 1995a].

TOMS data are recorded on the spacecraft and then downlinked and transmitted to the TOMS Science Operations Center at the Goddard Space Flight Center for rapid processing. In most cases, ozone values are mapped and made available as they are received (within hours), and full global maps are usually available within 36 hours. These data (along with the historical data sets) are made available on the TOMS home page (<http://jwocky.gsfc.nasa.gov>). Both numerical values of the ozone fields as well as color images (full globe, north polar projection, south polar projection) are available. EP TOMS data are also directly transmitted to S-band receiving stations in real time for processing and use in applications requiring rapid access to data. At this point all the TOMS results

should be considered preliminary since they are based on pre-flight calibrations and a first estimated in-orbit calibration correction.

Data on the other TOMS products (sulfur dioxide, volcanic ash plumes, tropospheric aerosol information, surface ultraviolet radiation flux, surface ultraviolet reflectivity, tropospheric ozone determined based on some assumption about stratospheric ozone distributions) are not yet available for immediate access, although it is expected that they will be in the future. Scientists interested in these data are advised to contact the TOMS project scientist, Dr. P. K. Bhartia (contact information is provided in the main part of this NRA) for information on access to these data. A brief description of these additional data sets follows:

- TOMS measures the sulfur dioxide (SO₂) column following large volcanic eruptions. A significant record of observations of volcanic SO₂ has been built up over the years [Krueger et al., 1995b] and is now being extended with the current TOMS instruments. Images of volcanic sulfur dioxide and ash plumes are available electronically at <http://skye.gsfc.nasa.gov>.
- Volcanic ash plumes in the troposphere have also been observed with TOMS instruments. Typically, these plumes can only be observed for a few days before their dispersal. The TOMS volcanic ash product is described by Seftor et al. [1996].
- Information on tropospheric aerosols is also obtained by the TOMS instruments. These measurements make use of the wavelength dependence of UV reflectivity measured at channels which are little affected by ozone [Hsu et al., 1996; Herman et al., 1997]. In the earlier TOMS instruments, there were several such channels; in particular, the 331.3, 360 and 380 nm channels provided excellent long-wavelength information. Although the 380 nm channel was eliminated in the new TOMS instruments, tropospheric aerosol measurements will still be possible using the 360 nm and 331.3 nm channels. TOMS can clearly observe UV-absorbing materials such as mineral desert dust, volcanic ash, and smoke from fires.
- The average flux of ultraviolet radiation at the Earth's surface can also be determined from TOMS. Knowing the solar flux entering the atmosphere (determined using spectrally-resolved solar irradiance data from instruments aboard NASA's Upper Atmosphere Research Satellite), the total ozone measured from TOMS, and information on cloud cover provided by the long wavelength TOMS channels, radiative transfer models can accurately estimate the amount of ultraviolet radiation reaching the surface. This technique was validated by comparison with ground-based measurements made in Toronto [Eck et al., 1995] and recently shown to have information on trends over most of the Earth [Herman et al., 1996].
- TOMS has also been used to determine the first surface reflectivity climatology of the Earth's surface (oceans and land) in the near UV [Herman and Celarier, 1997].
- Although tropospheric ozone cannot be directly measured by TOMS, information on its distribution can be obtained by subtracting stratospheric ozone as measured by some other instrument - Stratospheric Aerosol and Gas Experiment (SAGE II), Solar Backscatter Ultraviolet (SBUV/2), or Microwave Limb Sounder (MLS) - from the TOMS total

column. This is the so-called tropospheric ozone residual (TOR) technique developed by Fishman et al. [1996] and others [Vukovich et al., 1996; Ziemke et al., 1996].

Tropospheric ozone can also be derived directly from TOMS by making some assumption about the variation of stratospheric ozone [Kim et al., 1996].

Science teams were originally established for these TOMS instruments based on the principal investigators and co-investigators on the proposals submitted for each instrument, as well as subsequent changes approved by NASA. Given the long time period between selection and launch, however, a decision has been made to recompute the science teams and to establish a single unified science team for all TOMS instruments. This includes not only the EP and ADEOS TOMS instruments, but also that to be launched aboard a Russian Meteor-3M spacecraft in the year 2000.

Because of the commonality between the TOMS instruments and the Solar Backscatter Ultraviolet series of instruments (SBUV/2), investigators selected for the TOMS science team may also carry out appropriate investigations relevant to SBUV/2. Like TOMS, SBUV/2 uses the backscatter ultraviolet technique to obtain information on total column ozone amounts (with much reduced spatial coverage than TOMS because it does not do cross-track scanning), but it also provides information on the vertical profile of ozone, especially in the middle and upper stratosphere.

Proposals in seven different areas are desired for the reconstituted TOMS Science Team:

- TOMS/SBUV Validation - Support would be provided for a limited number of measurements designed for comparison with TOMS data. This would be for focused comparisons, and should **not** be used to support existing networks unless specific measurements are required for TOMS validation. Data products of greatest interest for focused validation studies include TOMS tropospheric ozone products (including those obtained using the Total Ozone Residual method) and TOMS tropospheric aerosol products. Other products for which validation is a lesser priority include sulfur dioxide measurements, total ozone measurements, and surface ultraviolet radiation. **This is the only category of TOMS Science Team activity for which support of field measurements will be considered.**
- TOMS/SBUV Trend Studies - Support for analyses of long-term data sets on total column ozone amounts (TOMS, SBUV/2) and ozone vertical profile measurements (SBUV/2), including comparison with appropriate ground- and balloon-based measurement networks (Dobson/Umkehr, ozonesondes, etc). A major focus of this will be cross-instrument trend studies, and examinations of interconsistency between ozone measurements provided by various space-based instruments. Studies of the detailed relationships of instrument performance to retrieved ozone distributions are important in this category.
- BUV Algorithm Improvement - Support for studies of improvements to the retrieval algorithms used for the TOMS and SBUV/2 instruments will be provided. This covers not only the traditional BUV products (total ozone, ozone vertical profile, sulfur dioxide) but also the newer topics (tropospheric ozone, tropospheric aerosols, surface UV radiation, other products as may be determined).

- Tropospheric Aerosols - Support for analysis of the TOMS tropospheric aerosol product, including comparisons of TOMS-derived information on aerosol abundance with that from surface-, airborne-, balloon-, and space-based information on aerosol distribution properties and photometric measurements is included here. Determination of climatologies and summaries of variability of aerosol measurements are also included.
- Tropospheric Ozone - Support for determination of tropospheric ozone distributions using TOMS, either together with other data sets through the Tropospheric Ozone Residual (TOR) method, or independently based on assumptions about stratospheric ozone variations, is considered here. Combinations of TOMS and/or SBUV/2 data with other satellite data sets would be considered. Critical evaluation of TOMS-derived tropospheric ozone distributions based on profiles from ozonesondes, tropospheric lidars, etc. is highly desired.
- Surface Ultraviolet Radiation - Support for further analysis and validation of the TOMS surface ultraviolet radiation product is desired here. Comparison of the current product with surface-based measurements, as well as suggestions for improvements in the current product based on inclusion of other data sources, will be considered here.
- Applications - Support for studies in which TOMS data can be of use to the broader scientific and operational communities, focusing especially on applications to meteorology, will be considered here. These include use of TOMS data for studies of tropospheric meteorology (including its use in forecasting procedures), hazard avoidance, and smoke/particle detection

Specific Instructions to Proposers

Although proposals from all interested members of the scientific community are desired, programmatic considerations and funding limitations place the following restrictions on proposals submitted in response to this NRA:

- The content of the proposal should provide sufficient detail to enable a reviewer to comprehend the nature of the proposed research and to assess its value, its relationship to the goals of ACMAP or the TOMS Science Team, and the probability that the investigators will be able to accomplish the stated objectives within the requested resources.
- **The technical part of the proposal should be limited to the equivalent of 15 single-spaced typewritten pages.** Additional pertinent information including publications, data, etc., may be added as attachments. Each proposal should contain the information indicated in Section (c) of Appendix B. Proposals should explicitly state on their cover sheets if the proposal is to be considered under ACMAP, the TOMS Science Team, or both. **Note that proposals for correlative measurements and/or TOMS validation can only be considered under the TOMS Science Team since ACMAP does not support the obtaining of measurements.**
- Respondents having support from other NASA/MTPE programs, including other tasks within ACMAP, should include clear, concise statements of how their work proposed under this NRA complements and/or extends their current MTPE-funded work.

- If the proposed research is a renewal of an existing ACPMAP task, a clear statement of the accomplishments of the investigators in their current research relative to the research plan outlined in the corresponding proposal should be included in a separate section. **This part should be limited to the equivalent of 5 single-spaced typewritten pages**, which are **in addition** to the 15 page limit described above. Reviewers will be asked to explicitly comment on this section of the proposal.
- All US investigators should include in each year the cost of one three day program review in the vicinity of Washington, DC in their budgets.
- Included with this NRA as Appendix D are (1) Form ED 80-0004 "Certification Regarding Drug-Free Workplace Requirements: Grantees Other Than Individual," (2) Form ED GCS-008 (REV. 12/88), "Certification Regarding Debarment, Suspension, and other Responsibility Matters: Primary Covered Transactions," and (3) Form GCS-008 (REV. 12/88), "Certification Regarding Lobbying." Also included is a cover sheet which should be completed and used with each proposal. One set of these completed forms must be included with the original signature version of all proposals.

References

- Eck, T. F., P. K. Bhartia, and J. B. Kerr, Satellite estimation of spectral UVB irradiance using TOMS derived ozone and reflectivity, *Geophys. Res. Lett.*, 22, 611-614, 1995.
- Fishman, J., V. B. Brackett, E. V. Browell, and W. B. Grant, Tropospheric ozone derived from TOMS/SBUV measurements during TRACE A, *J. Geophys. Res.*, 101, 24,069-24,082, 1996.
- Herman, J. R., P. K. Bhartia, J. Ziemke, Z. Ahmad, and D. Larko, UV-B increases (1979-1992) from decreases in total ozone, *Geophys. Res. Lett.*, 23, 2117-2120, 1996.
- J. R. Herman and E. A. Celarier, Earth surface reflectivity climatology at 340 nm to 380 nm from Nimbus-7/TOMS data, submitted to *J. Geophys. Res.*, 1997.
- Herman, J. R., P. K. Bhartia, O. Torres, C. Hsu, C. Sefton, and E. Celarier, Global distribution of UV-absorbing aerosols from Nimbus-7/TOMS data, *J. Geophys. Res.*, in press, 1997.
- Hsu, N. C., J. R. Herman, P. K. Bhartia, C. J. Sefton, O. Torres, A. M. Thompson, J. F. Gleason, T. F. Eck, and B. N. Holben, Detection of biomass burning smoke from TOMS measurements, *Geophys. Res. Lett.*, 23, 745-748, 1996.
- Kim, J. H., R. D. Hudson, and A. M. Thompson, A new method of deriving time-averaged tropospheric column ozone over the tropics using total ozone mapping spectrometer (TOMS) radiances: Intercomparison and analysis using TRACE A data, *J. Geophys. Res.* 101, 24,317-24,330, 1996.
- Krueger, A. J., G. Jaross, and U. Hartmann, Design of the ADEOS/TOMS instrument for ozone trend assessment, *Proc. SPIE*, 2583, 235-244, 1995a.

Krueger, A. J., L. S. Walter, P. K. Bhartia, C. C. Schnetzler, N. A. Krotkov, I. Sprod, and G. J. S. Bluth, Volcanic sulfur dioxide measurements from the Total Ozone Mapping Spectrometer (TOMS) Instruments. *J. Geophys. Res.*, *100*, 14,057-14,076, 1995b.

Seftor, C. J., N. C. Hsu, J. R. Herman, P. K. Bhartia, O. Torres, W. I. Rose, D. J. Schneider, and N. Krotkov, Detection of volcanic ash clouds from Nimbus-7/TOMS reflectivity data, submitted to *J. Geophys. Res.*, 1996.

Vukovich, F., M., V. Brackett, J. Fishman, and J. Sickles, On the feasibility of using the tropospheric ozone residual (TOR) for nonclimatological studies on a quasi-global scale, *J. Geophys. Res.*, *101*, 9093-9105, 1996.

Ziemke, J. R., S. Chandra, A. M. Thompson, and D. P. McNamara, Zonal asymmetries in southern hemisphere column ozone: Implications of biomass burning, *J. Geophys. Res.*, *101*, 14,421-14,427, 1996.

Appendix B

INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS

(JANUARY 1997)

(a) General.

(1) Proposals received in response to a NASA Research Announcement (NRA) will be used only for evaluation purposes. NASA does not allow a proposal, the contents of which are not available without restriction from another source, or any unique ideas submitted in response to an NRA to be used as the basis of a solicitation or in negotiation with other organizations, nor is a pre-award synopsis published for individual proposals.

(2) A solicited proposal that results in a NASA award becomes part of the record of that transaction and may be available to the public on specific request; however, information or material that NASA and the awardee mutually agree to be of a privileged nature will be held in confidence to the extent permitted by law, including the Freedom of Information Act.

(3) NRAs contain programmatic information and certain requirements which apply only to proposals prepared in response to that particular announcement. These instructions contain the general proposal preparation information which applies to responses to all NRAs.

(4) A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded in response to an NRA. NASA will determine the appropriate instrument. Contracts resulting from NRAs are subject to the Federal Acquisition Regulation and the NASA FAR. Supplement. Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPG 5800.1).

(5) NASA does not have mandatory forms or formats for responses to NRAs; however, it is requested that proposals conform to the guidelines in these instructions. NASA may accept proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the proposers' most favorable terms.

(6) To be considered for award, a submission must, at a minimum, present a specific project within the areas delineated by the NRA; contain sufficient technical and cost information to permit a meaningful evaluation; be signed by an official authorized to legally bind the submitting organization; not merely offer to perform standard services or to just provide computer facilities or services; and not significantly duplicate a more specific current or pending NASA solicitation.

(b) NRA-Specific Items. Several proposal submission items appear in the NRA itself: the unique NRA identifier; when to submit proposals; where to send proposals; number

of copies required; and sources for more information. Items included in these instructions may be supplemented by the NRA.

(c) The following information is needed to permit consideration in an objective manner. NRAs will generally specify topics for which additional information or greater detail is desirable. Each proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

(1) Transmittal Letter or Prefatory Material.

- (i) The legal name and address of the organization and specific division or campus identification if part of a larger organization;
- (ii) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;
- (iii) Type of organization: e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;
- (iv) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;
- (v) Identification of other organizations that are currently evaluating a proposal for the same efforts;
- (vi) Identification of the NRA, by number and title, to which the proposal is responding;
- (vii) Dollar amount requested, desired starting date, and duration of project;
- (viii) Date of submission; and
- (ix) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization (unless the signature appears on the proposal itself).

(2) Restriction on Use and Disclosure of Proposal Information. Information contained in proposals is used for evaluation purposes only. Offerors or quoters should, in order to maximize protection of trade secrets or other information that is confidential or privileged, place the following notice on the title page of the proposal and specify the information subject to the notice by inserting an appropriate identification in the notice. In any event, information contained in proposals will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

Notice

Restriction on Use and Disclosure of Proposal Information

The information (data) contained in [insert page numbers or other identification] of this proposal constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract (or other agreement) is awarded on the basis of this proposal the Government shall have the right to use and disclose this information (data) to the extent provided in the contract (or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

(3) **Abstract.** Include a concise (200-300 word if not otherwise specified in the NRA) abstract describing the objective and the method of approach.

(4) **Project Description.**

(i) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance; relation to the present state of knowledge; and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the plan of work, including the broad design of experiments to be undertaken and a description of experimental methods and procedures. The project description should address the evaluation factors in these instructions and any specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Subcontracting significant portions of a research project is discouraged.

(ii) When it is expected that the effort will require more than one year, the proposal should cover the complete project to the extent that it can be reasonably anticipated. Principal emphasis should be on the first year of work, and the description should distinguish clearly between the first year's work and work planned for subsequent years.

(5) **Management Approach.** For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and arrangements for ensuring a coordinated effort should be described.

(6) **Personnel.** The principal investigator is responsible for supervision of the work and participates in the conduct of the research regardless of whether or not compensated under the award. A short biographical sketch of the principal investigator, a list of principal publications and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

(7) **Facilities and Equipment.**

(i) Describe available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any Government-owned facilities, industrial plant equipment, or special tooling that are proposed for use. Include evidence of its availability and the cognizant Government points of contact.

(ii) Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative. Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for research and non-research purposes should be explained.

(8) Proposed Costs.

(i) Proposals should contain cost and technical parts in one volume: do not use separate "confidential" salary pages. As applicable, include separate cost estimates for salaries and wages; fringe benefits; equipment; expendable materials and supplies; services; domestic and foreign travel; ADP expenses; publication or page charges; consultants; subcontracts; other miscellaneous identifiable direct costs; and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and engineering professionals, graduate students, research assistants, and technicians and other non-professional personnel). Estimate all staffing data in terms of staff-months or fractions of full-time.

(ii) Explanatory notes should accompany the cost proposal to provide identification and estimated cost of major capital equipment items to be acquired; purpose and estimated number and lengths of trips planned; basis for indirect cost computation (including date of most recent negotiation and cognizant agency); and clarification of other items in the cost proposal that are not self-evident. List estimated expenses as yearly requirements by major work phases.

(iii) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 1831 (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations).

(9) **Security.** Proposals should not contain security classified material. If the research requires access to or may generate security classified information, the submitter will be required to comply with Government security regulations.

(10) **Current Support.** For other current projects being conducted by the principal investigator, provide title of project, sponsoring agency, and ending date.

(11) Special Matters.

(i) Include any required statements of environmental impact of the research, human subject or animal care provisions, conflict of interest, or on such other topics as may be required by the nature of the effort and current statutes, executive orders, or other current Government-wide guidelines.

(ii) Proposers should include a brief description of the organization, its facilities, and previous work experience in the field of the proposal. Identify the cognizant Government audit agency, inspection agency, and administrative contracting officer, when applicable.

(d) Renewal Proposals

(1) Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. A renewal proposal should not repeat all of the information that was in the original proposal. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of

the research are expected to be covered during the period for which support is desired. A description of any significant findings since the most recent progress report should be included. The renewal proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.

(2) NASA may renew an effort either through amendment of an existing contract or by a new award.

(e) **Length.** Unless otherwise specified in the NRA, effort should be made to keep proposals as brief as possible, concentrating on substantive material. Few proposals need exceed 15-20 pages. Necessary detailed information, such as reprints, should be included as attachments. A complete set of attachments is necessary for each copy of the proposal. As proposals are not returned, avoid use of "one-of-a-kind" attachments.

(f) Joint Proposals.

(1) Where multiple organizations are involved, the proposal may be submitted by only one of them. It should clearly describe the role to be played by the other organizations and indicate the legal and managerial arrangements contemplated. In other instances, simultaneous submission of related proposals from each organization might be appropriate, in which case parallel awards would be made.

(2) Where a project of a cooperative nature with NASA is contemplated, describe the contributions expected from any participating NASA investigator and agency facilities or equipment which may be required. The proposal must be confined only to that which the proposing organization can commit itself. "Joint" proposals which specify the internal arrangements NASA will actually make are not acceptable as a means of establishing an agency commitment.

(g) **Late Proposals.** A proposal or modification received after the date or dates specified in an NRA may be considered if doing so is in the best interests of the Government.

(h) **Withdrawal.** Proposals may be withdrawn by the proposer at any time before award. Offerors are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances which dictate termination of evaluation.

(i) Evaluation Factors

(1) Unless otherwise specified in the NRA, the principal elements (of approximately equal weight) considered in evaluating a proposal are its relevance to NASA's objectives, intrinsic merit, and cost.

(2) Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to NASA's mission.

(3) Evaluation of its intrinsic merit includes the consideration of the following factors of equal importance:

- (i) Overall scientific or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.
- (ii) Offeror's capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.
- (iii) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel critical in achieving the proposal objectives.
- (iv) Overall standing among similar proposals and/or evaluation against the state-of-the-art.

(4) Evaluation of the cost of a proposed effort may include the realism and reasonableness of the proposed cost and available funds.

(j) **Evaluation Techniques.** Selection decisions will be made following peer and/or scientific review of the proposals. Several evaluation techniques are regularly used within NASA. In all cases proposals are subject to scientific review by discipline specialists in the area of the proposal. Some proposals are reviewed entirely in-house, others are evaluated by a combination of in-house and selected external reviewers, while yet others are subject to the full external peer review technique (with due regard for conflict-of-interest and protection of proposal information), such as by mail or through assembled panels. The final decisions are made by a NASA selecting official. A proposal which is scientifically and programmatically meritorious, but not selected for award during its initial review, may be included in subsequent reviews unless the proposer requests otherwise.

(k) **Selection for Award.**

(1) When a proposal is not selected for award, the proposer will be notified. NASA will explain generally why the proposal was not selected. Proposers desiring additional information may contact the selecting official who will arrange a debriefing.

(2) When a proposal is selected for award, negotiation and award will be handled by the procurement office in the funding installation. The proposal is used as the basis for negotiation. The contracting officer may request certain business data and may forward a model award instrument and other information pertinent to negotiation.

(l) **Cancellation of NRA.** NASA reserves the right to make no awards under this NRA and to cancel this NRA. NASA assumes no liability for canceling the NRA or for anyone's failure to receive actual notice of cancellation.

APPENDIX C

GUIDELINES FOR FOREIGN PARTICIPATION

NASA accepts proposals from entities located outside the U.S. in response to this NRA. Proposals from non-U.S. entities should not include a cost plan. Non-U.S. proposals, and U.S. Proposals that include non-U.S. participation, must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the non-U.S. participant is proposing. Such endorsement should indicate the following points: (1) The proposal merits careful consideration by NASA; and (2) If the proposal is selected, sufficient funds will be made available by the sponsoring foreign agency to undertake the activity as proposed.

Proposals, along with the requested number of copies and Letter of Endorsement must be forwarded to NASA in time to arrive before the deadline established for this NRA. In addition, one copy of each of these documents should be sent to:

NASA Headquarters
Office of External Relations
Mission to Planet Earth Division, Code IY
Washington, DC 20546
USA

Any materials sent by courier or express mail should include the street address 300 E Street, S. W., and substitute 20024 for the indicated ZIP code.

All proposals must be typewritten in English. All non-U.S. proposals will undergo the same evaluation and selection process as those originating in the U.S. Non-U.S. proposals and U. S. Proposals that include non-U.S. participation, must follow all other guidelines and requirements described in this NRA. Sponsoring non-U.S. agencies may, in exceptional situations, forward a proposal without endorsement to the above address, if review and endorsement are not possible before the announced closing date. In such cases, however, NASA's Mission to Planet Earth Division of the Office of External Relations should be advised when a decision on the endorsement is to be expected.

Successful and unsuccessful proposers will be contacted directly by the NASA Program Office coordinating the NRA. Copies of these letters will be sent to the sponsoring government agency.

Appendix D

Certification Regarding Debarment, Suspension, and Other Responsibility Matters Primary Covered Transactions

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 34 CFR Part 85, Section 85.510, Participant's responsibilities. The regulations were published as Part VII of the May 26, 1988 Federal Register (pages 19160-19211). Copies of the regulation may be obtained by contracting the U.S. Department of Education, Grants and Contracts Service, 400 Maryland Avenue, S.W. (Room 3633 GSA Regional Office Building No. 3), Washington, DC. 20202-4725, telephone (202) 732-2505.

- (1) The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:
- (a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
 - (b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
 - (c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and
 - (d) Have not within three-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated for cause or default.
- (2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Organization Name

PR/Award Number or Project Name

Name and Title of Authorized Representative

Signature

Date

Appendix D

Certification Regarding Drug-Free Workplace Requirements Grantees Other Than Individuals

This certification is required by the regulations implementing the Drug-Free Workplace Act of 1988, 34 CFR Part 85, Subpart F. The regulations, published in the January 31, 1989 Federal Register, require certification by grantees, prior to award, that they will maintain a drug-free workplace. The certification set out below is a material representation of fact upon which reliance will be placed when the agency determines to award the grant. False certification or violation of the certification shall be grounds for suspension of payments, suspension or termination of grants, or governmentwide suspension or debarment (see 34 CFR Part 85, Sections 85.615 and 85.620).

This grantee certifies that it will provide a drug-free workplace by:

- (a) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession or use of a controlled substance is prohibited in the grantee's workplace and specifying the actions that will be taken against employees for violation of such prohibition;
- (b) Establishing a drug-free awareness program to inform employees about -
 - (1) The dangers of drug abuse in the workplace;
 - (2) The grantee's policy of maintaining a drug-free workplace;
 - (3) Any available drug counseling, rehabilitation, and employee assistance programs; and
 - (4) The penalties that may be imposed upon employees for drug abuse violations in the workplace;
- (c) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (a);
- (d) Notifying the employee in the statement required by paragraph (a) that, as a condition of employment under the grant, the employee will -
 - (1) Abide by the terms of the statement; and
 - (2) Notify the employer of any criminal drug statute conviction for a violation occurring in the workplace no later than five days after such conviction;
- (e) Notifying the agency within ten days after receiving notice under subparagraph (d)(2) from an employee or otherwise receiving actual notice of such conviction;
- (f) Taking one of the following actions, within 30 days of receiving notice under subparagraph (d)(2) , with respect to any employee who is so convicted -
 - (1) Taking appropriate personnel action against such an employee, up to and including termination; or
 - (2) Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency;
- (g) Making a good faith effort to continue to maintain a drug-free workplace through implementation of paragraph (a), (b), (c), (e), and (f).

Organization Name

PR/Award Number or Project Name

Name and Title of Authorized Representative

Signature

Date

ED 80-0004

Appendix D

CERTIFICATION REGARDING LOBBYING

Certification for Contracts, Grants, Loans, and Cooperative Agreements.

The undersigned certifies, to the best of his or her knowledge and belief, that:

- (1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- (3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000, and not more than \$100,000 for each such failure.

Signature and Date

Name and Title of Authorized Representative

Organization Name

Appendix D

Proposal Cover Sheet NASA Research Announcement 97-MTPE-07

Proposal No. _____ (Leave Blank for NASA Use)

Title: _____

Principal Investigator:

Name: _____

Department: _____

Institution: _____

Street/PO Box: _____

City: _____ State: _____ Zip: _____

Country: _____ E-mail: _____

Telephone: _____ Fax: _____

Co-Investigators:

Name

Institution

Telephone

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Budget:

1st Year: _____ 2nd Year: _____ 3rd Year: _____ Total: _____

Type of Proposal:

Atmospheric Chemistry Modeling and Analysis Program Proposal _____

Total Ozone Mapping Spectrometer Science Team Proposal _____

Consideration Requested in Both Programs _____

Authorizing Official: _____
(Name) (Institution)